# BV4629 User Guide

Update 2 September:

Devices are now fitted with differing flash memory chip sizes. This User Guide assumes that the device has a 16Mb Flash memory fitted which has 500 blocks available. If a 2Mb version is used then some of the Flash examples my not be able to be carried out

The BV4629 is an LCD Touch screen panel with a serial & I2C interface. This guide supplements the BV4629 Data Sheet and gives additional information on how to use this device. Various resources are available and are used in this guide these can be found at www.byvac.com under the BV4620 products display.

** Please see the above website for the latest datasheet

## *Getting Started*

This device has three methods of getting information in and out:

1. Via USB
2. Serial via a Microcontroller UART
3. Serial via the I2C interface.

For the purposes of simplicity it is assumed that the USB interface is being used. Information for the other interfaces can be found in the Data Sheet. The Serial (UART) interface simply mirrors the USB interface.

## *Non-Windows Users*

The software tools in the resources pack are designed for Windows XP. The BV4629 however will work with any serial communication device and the FTDI drives are now built into the Linux kernel.

### Installing the USB Drivers

The USB uses the now almost standard FTDI Chip (http://www.ftdichip.com/) That will install as a virtual COM port. The driver can be obtained from the resources pack or the latest one can be downloaded from the FTDI site.

The driver will be requested when the USB is first plugged in and is installed like any other driver. This is a simple process but if you have not done this before then detailed instructions can be found on the FTDI web site.

When connected the device will beep and display:

```
Serial Mode
Press CR...
```

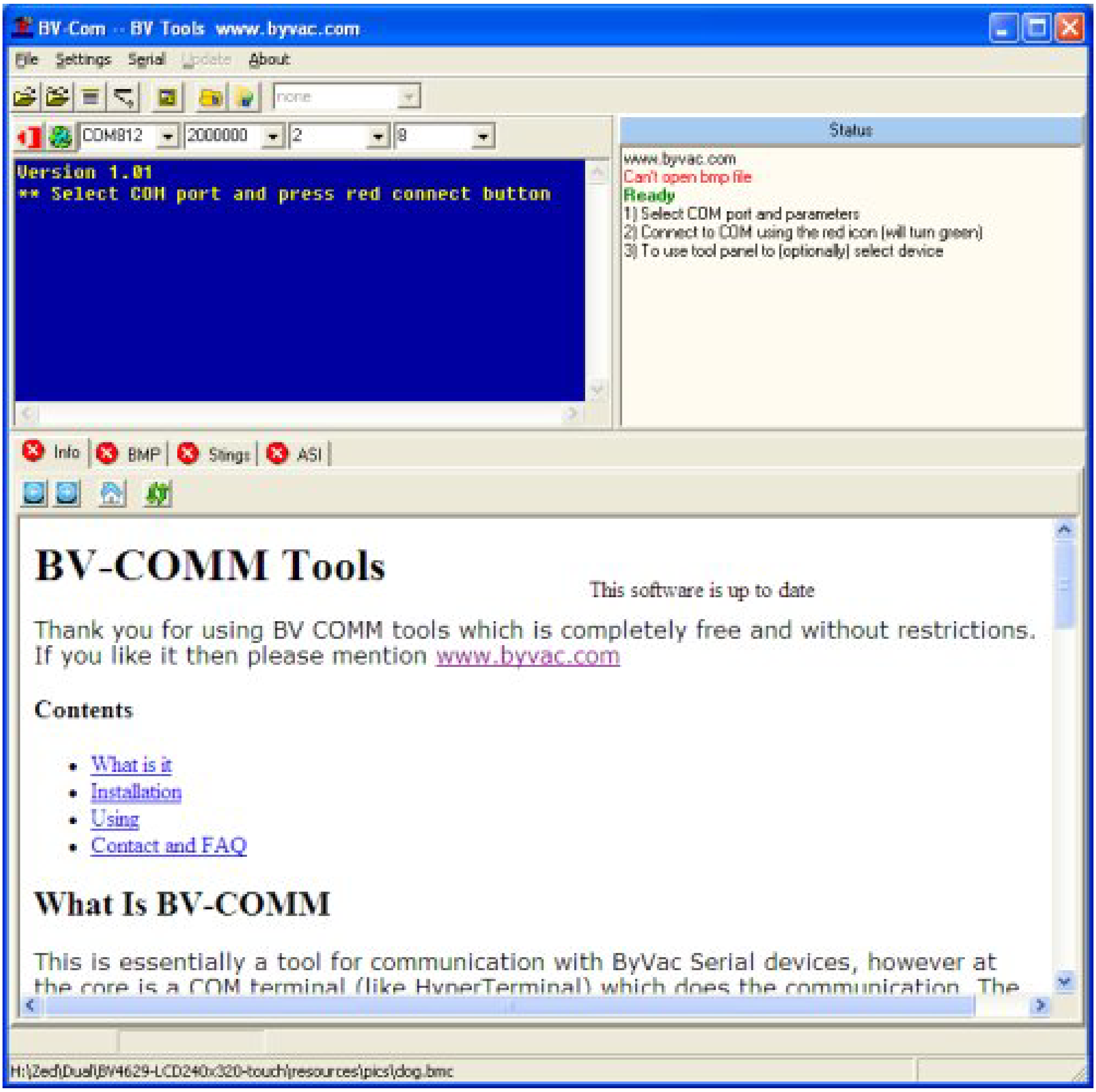
## BV-COM Tools

The BV4629 will operate as a serial device, commands are sent and received as text and so any Terminal software will operate the device, HyperTerminal for example. However there are so many features that this device has a special tool that has been written to enable a user to explore the features.

Basically it is a serial terminal with additional features specific to BV products. It also connects to the Internet and so any additional features or updates can be discovered.

## *Installation*

The tool does not really require any installation other than unzipping into a suitable directory. There are instructions on how to do this in the resources pack. The program simply runs by double clicking on the exe file.



```
Version 1.01
** Select COM port and press red connect button
```

www.byvac.com
Can't open bmp file
Ready
1) Select COM port and parameters
2) Connect to COM using the red icon (will turn green)
3) To use tool panel to (optionally) select device

BV-COMM Tools

This software is up to date

Thank you for using BV COMM tools which is completely free and without restrictions. If you like it then please mention www.byvac.com

Contents

- What is it
- Installation
- Using
- Contact and FAQ

What Is BV-COMM

This is essentially a tool for communication with ByVac Serial devices, however at the core is a COM terminal (like HyperTerminal) which does the communication. The

H:\Zed\Dual\BV4629-LCD240x320-touch\resources\pics\dog.bmc

**Figure 1 BV-COM Tools**

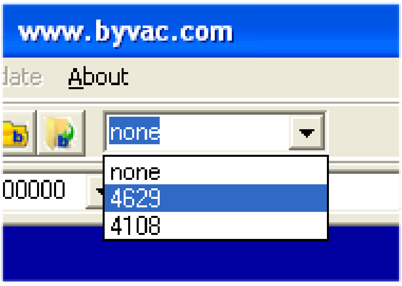
The main screen at the bottom of the tool is the help file for BV-Tools. If connected to the internet this will come from there if there is no internet connection then it will be a local file.

# Starting with BV4629

It is assumed that BV-Tools is up and running and the BV4629 is plugged into the USB and the COM port for this is known.

**Step 1**

Connect the BV4629 to the USB, make sure that the correct com port is selected and press the red, connect icon This will then turn green to show that a connection has been made. In the devices selector, just under the about box, select 4629



This will check the BV4629 to see if it is connected and enable various tabs. The first info tab should be shown that gives some explanation on how to use the BV4629. The status box to the right hand side of the blue com window will show extra details of what's going on. It is NORMAL to receive red error messages in this window. This is because all of the information is shown. The idea that this is a tool so that the device can be used in other applications, it is not an end device in itself. The messages may be useful for diagnosis and information.

**Step 2**

The device is now ready and anything typed into the blue COM window will appear on the display. A look at the data sheet will reveal that to clear the screen esc[2J to enter this press the escape key followed by 2J and the screen will clear. NOTE that case is important so esc[2j will be wrong and this will cause the device to beep.

## Commands

Anything types into the COM terminal, which equates with anything going out of the COM port, will appear on the screen with one exception and that is the byte value 27 (0x1b). This goes to the COM port when the escape key is pressed. The display will accept this value as the beginning of a command. The data sheet list all of the commands in the command table so to draw a line from co-ordinates 10,10 to 50,50 the command is esc{10 10 50 50L and so forth.

The command will react immediately, in the above case as soon as the 'L' is received. In some commands spaces are also important and so if a command appears not to work then re-read the description of the command in the data sheet.

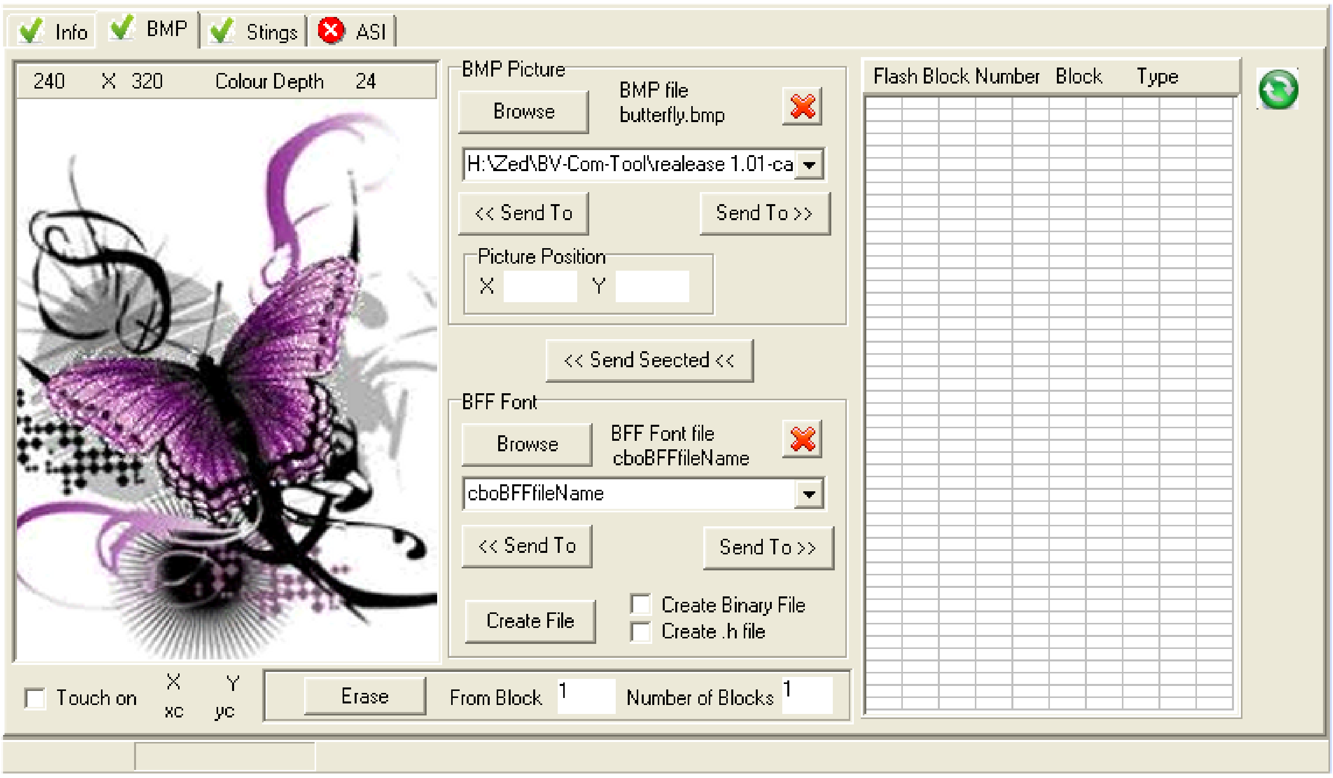
## Working With Pictures

The device will display any bitmap image provided that it is in the correct format. The BV Tool will take a BMP file, convert it to the correct format and then send it to the device. The BMP file MUST have a colour depth of 24 bits. A paint tool will be able to convert any format into this format which is sometimes called 32K or 64K colours.

As a demonstration select the BMP tab in BV-Tools. There is a picture called 'Butterfly.bmp' in the BV-Tools directory. If it is not in the picture panel as shown in Figure 2 then use the browse button to load it. Use the button pointing to the left to send it to the display at the current cursor position. Use the 'picture Position' boxes to send it to the display at differing co-ordinates; 0,0 for example.

**Information:**

It is important to realise that the BMP file is NOT being sent to the display. The BV-Tool will convert this file into another format before sending it.



240 X 320 Colour Depth 24

BMP file butterfly.bmp

H:\Zed\BV-Com-Tool\realease 1.01-ca

X Y

BFF Font file cboBFFfileName

cboBFFfileName

□ Create Binary File
□ Create .h file

□ Touch on X xc Y yc

From Block 1 Number of Blocks 1

**Figure 2 BMP Tab**

For a 'REAL' application you may want to convert the files into a suitable format for downloading via another application. To do this use the 'BMPConvert.exe' toll that is in the resource pack. This will convert BMP files to BMC files, the BMC file can be downloaded to the display by first giving the command esc{b and then sending the file through the serial interface.

Bit map files can also be stored on the Flash so that they can be presented on the display without the need for downloading first. This is ideal for static data such as buttons. There is more information about this in the section on Flash.

## Fonts

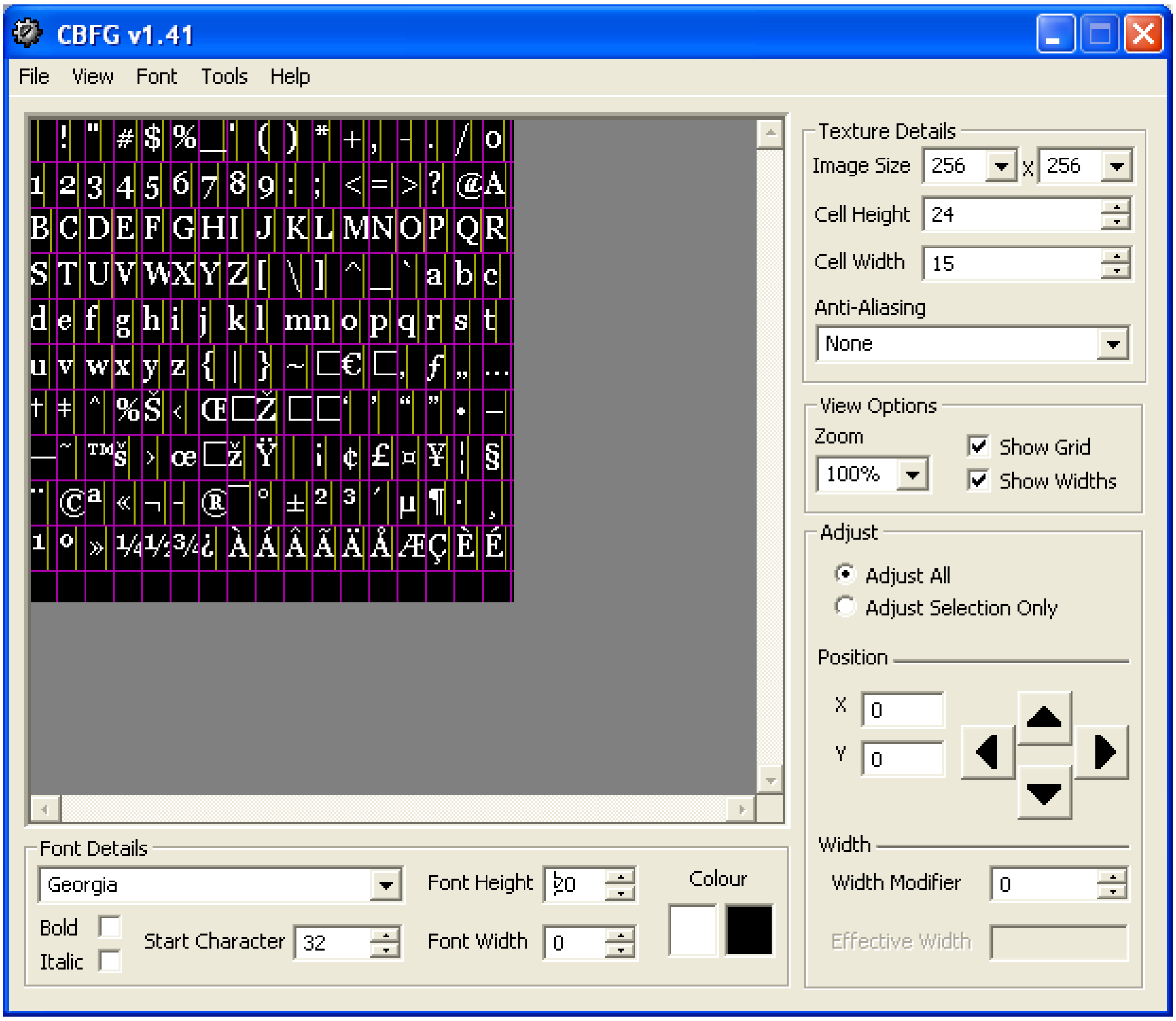
There are several built in fonts that can be accessed with esc(<number> where the number is the built in font number. Fonts can also be designed by the user and downloaded. A font file has an extension of BFF and just to show how this works use the browse button in the BFF Font section of the BMP tab and select 'Baskerville Old Face.bff'. This can be found in the resources zip file. When selected, press the '<< Send to' button and then type something in at the Blue COM screen, you should see that the text on the device is a different font.

### *Creating Fonts*

This is done with an excellent piece of free software from 'Codehead' (http://www.codehead.co.uk/cbfg/) The current version at the time of writing is in the resources zip file. The file is called CBFG.exe, just double click on it to get it working.

The program works by creating a bitmap of the selected font, this is then saved as a BFF file and the BFF file is converted by the BV-Tool for the display. Most of the fonts are proportional (differing widths) and the BV4629 will handle this.

To see how this works, launch CBFG and choose the Georgia font:



Texture Details

Image Size 256 x 256

Cell Height 24

Cell Width 15

Anti-Aliasing None

View Options

Zoom 100%

☑ Show Grid

☑ Show Widths

Adjust

● Adjust All

○ Adjust Selection Only

Position

X 0

Y 0

Width

Width Modifier 0

Effective Width

Font Details

Georgia

Bold □

Italic □

Start Character 32

Font Height 20

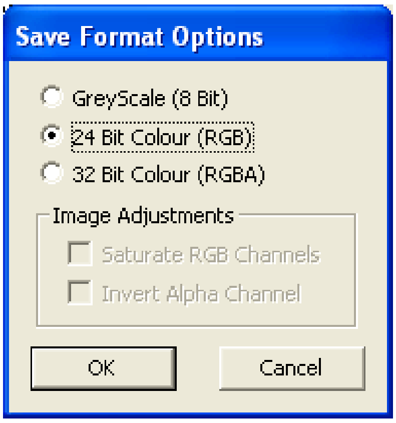
Font Width 0

Colour

**Figure 3 CBFG Program from 'Codehead'**

Choose the settings as shown in Figure 3. Don’t forget that this display is small relative to a PC screen and so the modest cell height and width above are still medium sized.

Save the file using file>save and choose the 24 bit option:


Save Format Options

○ GreyScale (8 Bit)

● 24 Bit Colour (RGB)

○ 32 Bit Colour (RGBA)

Image Adjustments

□ Saturate RGB Channels

□ Invert Alpha Channel

This will save the BFF file which can be imported into the BV-Tool and subsequently sent to the device.

Don’t expect all the features to work 100%, the colour for example must be black. This of course can be changed at the device level by selecting a different foreground colour.

For applications other than using the BV-Tool the BFF file is not suitable for sending directly to the display. In this case a 'BF' (Binary format) file is required. This can be created using the BV-Tool by selecting the appropriate tick box, in this case 'Create Binary file' and using the Create File button.

This file can then be loaded down the serial port using the esc(0 (zero) command.

## Flash Memory

For devices fitted with less than 16Mb, blocks outside the range will show as red (not blank). The following text assumes that 16Mb is fitted.

The display has a 16Mb (2M Byte) flash memory for storing mainly display data. The memory can hold system data, font data, picture data and macro data. It is organised as 500 (0 to 499) blocks of 4kB each.

The blocks must be erased before being written to, there are no checks so it is up to the user to make sure that the blocks being written to are blank. If the blocks are not blank then the data will be corrupt and unpredictable results will be achieved.

Writing data to the flash is carried out using the appropriate command for the data being stored. The data is sent to the serial port after the command has been issued.

To assist with the use of flash memory the BV-Tool provides a display:

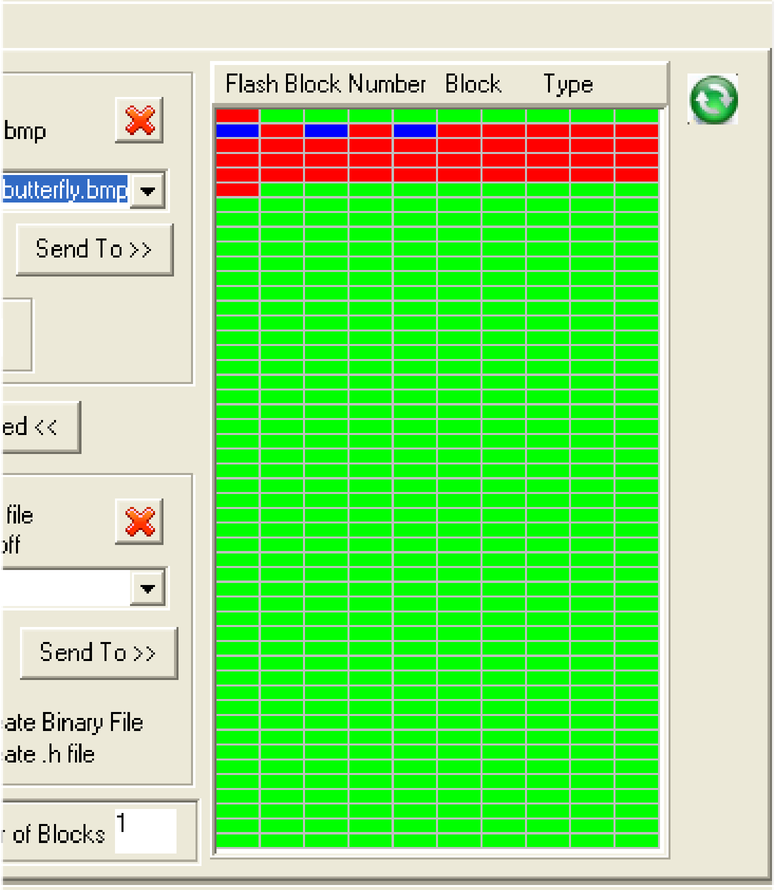


**Figure 4 Flash Memory Map**

Click the refresh button and the panel should 'colour in', this can also be displayed on the actual device by using esc[f command, try it and it should be exactly the same as the one on the PC screen – which may not be the same as shown in Figure 4.

RED: This means that the block is not blank

GREEN : This means that the block is blank

BLUE: Is the START of a bitmap

YELLOW: Is the start of macro

FUCHA: Is the start of a Font

Each rectangle represents one 4k block of memory, there are 10 across and 50 down making a total of 500 blocks numbered from 0. In Figure 4 block 0 is red, this is the system block. Block 10 is blue so this must be the start of a picture, as must blocks 12 and 14. Some indication is given to the size of the pictures, the first two occupy two blocks and the last one occupies 17 blocks including the start.

This map is obtained by BV-Tool using the esc{<bl>q command that returns a value indicating what is in the block. The command has to be sent 500 times to obtain a full picture.

## System Data

Block 0 contains system data such as the Baud Rate, screen calibration and the like. It is normally written to and read by the system using system commands, for example esc[?27D (look it up). The user can still delete this block, the system will then revert to some default values.

## Picture Data

Picture data takes up the most space. A full screen is 240 x 320 x 3 which is 230kB or 56 blocks. For most applications a full screen will not be required, several buttons could be stored for example that change as the application progresses. Each button can be stored in its own block. The retrieval and display of a bitmap is much quicker when used from Flash as it does not have to be serially loaded. As an example load the butterfly picture to block 60 (7 lines down). Do this by picking on block 60 with the mouse. The top of the map will tell you that block 60 has been selected. With the butterfly picture loaded, click the Send To >> button pointing to the flash. This is obviously the top Send To >> button as this is in the BMP group. The one at the bottom is for the fonts.

After a few seconds, refresh 🔄 the map again and you will see there is a lot more red. Clear the **device screen first** by typing **esc[2J** in the blue COM screen, click on block 60 again, this will now be blue and click the long '<< Send Selected <<' button. The picture will appear on the screen.

There are a couple of things that may not be clear about what is happening when using this demonstration. The first is that the picture data is not coming from the PC but is now internal to the device and so that picture can be displayed independently. The second thing to appreciate is that the command for sending data from the Flash to the screen is the same command esc{<bl>r for all types of data. There is a marker placed on the data when it is saved and so the device knows how to display it.

## Font Data

In exactly the same why as pictures, fonts can also be stored to flash using the 'Send To >>' button but in the Font group. In this way many fonts can be stored and recalled with esc{<bl>r when required. Simply store the fonts into particular blocks and recall when needed by specifying that block.

## Macro Data

This can be used to automate a process and is simply a record of a set of commands. Of course these commands can call pictures and fonts. The macro can also be made to run at start up so a customisable start up or splash screen is possible. In a real application this could come on whilst the processor it is attached to boots up for example. There are some limitations when using a macro and these are repeated here form the data sheet.

1. The maximum size of a macro is 100 bytes. This is not a particular restriction as a macro can call text and other images from Flash.

2. When saving a macro to run at start up, the baud rate also becomes fixed to whatever it is currently set at.
3. Turning off the macro will not automatically turn off the fixed Baud rate.

**Sign on example**

To get the hang of using this feature an example follows that will display a sign on screen and then some text in a different font. The butterfly picture is too big as we need to put some text underneath, so store to flash, a picture called 'front_screen.bmp' at block 130. The macro sign on will be the following commands:

**#27[2J#27{130r#27(5New Sign On Screen**

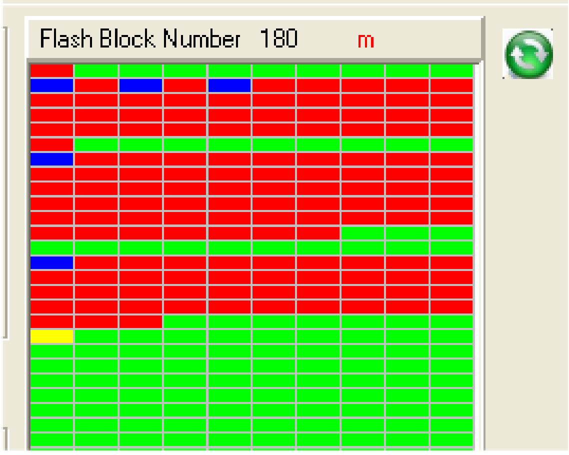
In the above string #27 represents the escape key. It is advisable to type this in at the COM screen first to make sure it works (see the strings section later for an easy way to do this).

To write the macro add the following:

**#27{180M#27[2J#27{130r#27(5New Sign On Screen#27#27**

The bits shown in red at the front and back. The first bit is the command to begin a macro and the 180 is the block number that it will be written to. The last two escapes are how a macro is terminated. When this string is entered there will be a macro block at 180.

This can be tested using the #27{180r command that will run the macro.



This is how the panel now looks after refresh, it can be seen that there is now a macro block at 180.

# Touch Screen

The BV4629 is equipped with a touch screen and there are various commands that manipulate this. The screen must be calibrated first. The calibration settings are stored in the system block (0) and at start up the display checks to see if it has been calibrated, if not it will prompt the user to re-calibrate which is a very simple process.

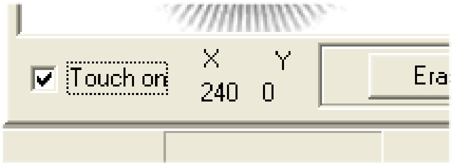
**Calibration**

The command for calibration is #27[c. After issuing this command it is a 'simple' matter of selecting 3 dots. The 'simple' is in quotes because it needs a steady hand and you must not touch the screen elsewhere with your hand. It takes a bit of practice. The calibration is only saved temporarily. To save it permanently to block 0 (the system block) then use the #27?27D command, note that this will also save the current settings and Baud rate.

**Interrupt**

When the screen is touched it will hold pin 2 of the serial interface connector low, it also sets an internal flag and the Ring indicator attached to the USB. To see how the software flag works, touch the screen and use the last touch command #27[l, it will show x,y,L where L will be 1. If you send the command again without touching the screen then the same co-ordinates will be returned but this time L will be 0, indicating that you have already, read those co-ordinates. This is the software interrupt flag.

The same applies for hardware, when the co-ordinates are read, the interrupt pin returns high, if you have a meter you can verify this. BV-Tools makes use of the Ring Indicator (RI in RS232 Speak). It is in-fact designed to wake up a modem when the telephone is ringing. Check the box to the lower left of the BMP tab page:



☑ Touch on

X 240

Y 0

Now touch the screen and you will see that the co-ordinates change. What BV-Tools is doing is detecting the RI and then issuing the last touch command to retrieve the co-ordinates. This happens quite quickly and so there may be one or two errors that show up in the status screen, this is normal.

This feature is very useful for obtaining the co-ordinates of buttons for example and then using Area hit. As an example of how this may work, we can load up some buttons and one of them will load another image.

1. Load up the ‘clock.bmp file from the resources zip and save it to block 190.
2. Now load up ‘front_screen.bmp’ from block 130 or if you have deleted it from the resources zip. (Use #27[2J to clear the screen first).
3. Find out the co-ordinates of the clock button. Pick the **top left** and **bottom right**, I get 69,158 and 112,213. Don’t forget that this may be different on your display.
4. Run this command #27{69,158,112,216H#27[2J#27{190r

This will wait until the screen has been touched in the correct place, as specified by the co-ordinates before returning, it will then clear the screen and display the larger clock. The following command will do all of the above in one go.

```
#27[2J#27{130r#27{69,158,109,206H#27[2J#27{190r
```

This is as far as you can go using scripts and without programming. In an application it is better to use the lower case ‘h’ version of the command as that command will return either 0 or 1 depending on where the screen was touched. The host program can then decide what to do.

When the command has been run the soft interrupt flag is set and this must be cleared by reading the last touch (#27[l).

## Strings

This is a useful utility which is in the process of being written and so there are some known bugs and issues.

To use this facility, pick on the ‘strings.scr’ file that is shown far right, this will populate the top index area. Click on one of the letters (T in the picture at Figure 5) and then on one of the words down the left hand side. You can edit the text in the main box, save it and send it to the COM port using the send button.

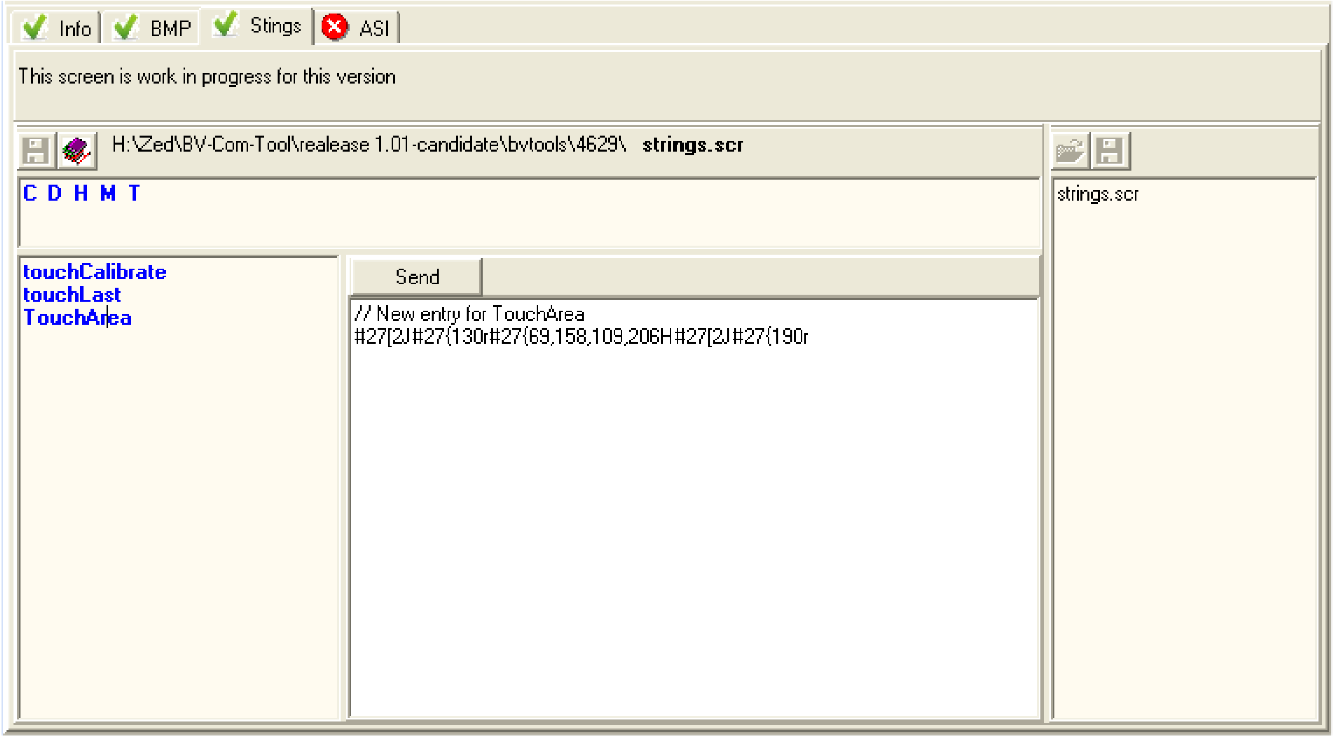
It will work most of the time and saves a lot of re-typing.

When using this remember that ALL characters are important and WILL be sent to the display including Line feed, so sending two ‘beeps’ to the diplay like this:

```
#27[900;2b
#27[850;2b
```

Will cause the display to beep twice but will also put the cursor down one. If no side effects are wanted the this would be the command to use:

```
#27[900;2b#27[850;2b
```



This screen is work in progress for this version

H:\Zed\BV-Com-Tool\realease 1.01-candidate\bvtools\4629\ **strings.scr**

C D H M T

touchCalibrate
touchLast
TouchArea

```
// New entry for TouchArea
#27[2J#27{130r#27{69,158,109,206H#27[2J#27{190r
```

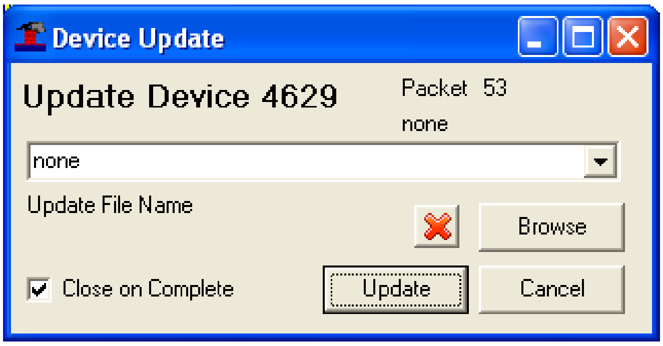
strings.scr

**Figure 5 Strings**

## *Firmware Update*

Should the firmware require upgrading then this is possible using BV-Tools. The current firmware can be found with this esc[?30a command and will be a decimal number.

New firmware if available can be found in the resources zip file or on the ByVac website, it will be a file with a .bin extension. To update the firmware simply use the Update menu that will show this dialog:



Packet 53
none

none

Update File Name

☑ Close on Complete

Select the file and press upload, it takes just a few seconds. The firmware update does not update the flash and so any system settings will remain.

## Factory Reset

Factory reset will simply delete the contents of the Flash system block 0. It could be possible that an impossible macro has been inadvertently programmed into this and is causing the device to not start up. In this instance the system block can be erased from a hardware 'instruction'

1. At the top of the display is a row of 10 holes, at one side there is a square one, this is pin 1. It is also marked as pin 1 on the PCB.
2. Disconnect the display and use a piece of wire to short out pins 3 & 4, just hold the wire in place by hand.

3. Connect the display and then remove the wire.

The display will now have a blank system block 0. You will see the calibration screen, calibrate the touch screen and the display is now back to ‘normal’

## Programming Notes

There are some important aspects to consider when using this device concerning the communication flow. The device has a serial buffer and so will accept up to about 80 bytes before becoming full. The buffer will become full when the incoming data is coming faster then the device can service it. When the buffer becomes full it pulls the RTS line low. This state should be monitored by the host and the host should stop sending until the RTS lines goes high again.

Receiving data from the touch screen is another consideration. A command is sent to the device and then the device will respond with information. The problem here is that the data is of variable length and so it is important to wait for the terminating character before reading the device. An example may better explain:

Host: sends out #27[l (last touch command)

Device: after a finite time responds with “110,65#13” In bytes this would be #49#49#48#44#54#53#13

It is important therefore not to read the device too early otherwise some data may be missed. The technique is to read in bytes from the device until #13 is received. This data can then be parsed to extract the co-ordinates. It may also be wise to incorporate a time out whilst waiting for the #13 in case something goes wrong.

An alternative to waiting for the #13 is to specify a particular character using the #27[<char>E command. Not all commands will respond with #13, using the #27[<char>E command will ensure that just about every command will respond with whatever is specified, this ensures that command like clear the screen that take a relatively long time will have completed before sending the next command.

In summary:

### Start up:

```
send #13  (to establish Baud rate)
send #27[#42E (to set the ACK at *)
```

### Send:

```
while RTS is high send data
```

### Receive:

```
while byte <> ‘*’ get byte, store byte to string
(return string when byte = ‘*’)
```

## *Tips & Notes*

### Device Dropdown & Reset

When selecting a device it uses the <device>.ini file to set up BV-Tools to what the device expects, it may set up ACK conditions CTS etc. So for correct operation, the conditions are mostly required.

If the device is reset using the reset icon then the conditions are lost and some features of BV-Tools will not work correctly. This will probably be indicated by lots of red text in the status panel. To get back the status quo select ‘none’ then the device again, this will re-read the .ini file and set up BV-Tools correctly.

## Internet

BV-Tools checks to see if there is an internet connection, if there is then the info pages are displayed from a directory off of the www.byvac.com site. In this way any updates or information are always available. If however the internet is not available then a local copy of the .htm files are used. If this is the case then it is advisable to check for updates. BV-Tool updates can be found at the above website in the section that deals with this device.

# Secret Demo

To activate this do the following:

1) load the picture paintButton.bmp into block 10
2) load the picture stylophone.bmp into block 12
3) load the picture stylophoneButton.bmp into block 14
4) reset and press enter.
5) pick the screen icon, bottom far left of the touch screen to start and the home icon to finish.